TESTING OF AN ORGANIC REMOVAL PROCESS IN BWR RADWASTE SYSTEMS

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Principal Investigator:

Robert Head
GE Nuclear Energy
195 Curtner Ave. MC 783
San Jose, CA 95125
U.S.A.
Phone: 408-925-6556

Project Manager:

T. Passell
Electric Power Research Institute
3412 Hillview Ave., P.O. Box 10412
Palo Alto, CA 94303
U.S.A.
Phone: 415-855-2070

Objectives: Naturally occurring organic plus lubricating oils and cleaning solvents are present in plant water systems. These compounds are not removed by the usual plant purification systems. A process based on ozone-ultraviolet radiation has been demonstrated to be capable of degrading and removing organics. The objectives of the study are:

- To optimize the ozone-ultraviolet treatment system parameters.
- To evaluate the effect of residual ozone on ion-exchange resins.
- To determine the reaction time required to effectively treat organic transients.
- To evaluate the efficiency of the process for removal of organics in both high- and low-purity wastes.
- To quantify the expected reduction in radwaste ion-exchange resin usage resulting from reduced organic concentration.

Comments:

- Pilot-scale tests were carried out at Vallecitos Nuclear Center followed by tests on radwaste systems at Dresden and Susquehanna.
- Process streams containing common organic contaminants were introduced into a vessel outfitted with ultraviolet lamps.
- Oxygen and ozone were fed continuously into the vessel.
- Oxidation of the organic was monitored as a function of time, and downstream ozone concentration was also measured.

The treatment system parameters were optimized as follows:

- 100 ppm ozone in combination with ultraviolet light oxidized 90% of the organic in 15-30 min.
- Ion-exchange resins helped remove the oxidized ions of organic acids, nitrates, and sulfates.
- In simulated organic transients or spills, 300 ppm ozone oxidized >90% of organic compounds even in turbid waters in times of up to 60 min.

- Electrohydraulic control fuel was efficiently removed, nonreactive silica was converted to a removable, reactive form.
- Essentially no ozone was detected in the effluent of the process, and there was no damage to the downstream resins.

Remarks/Potential for dose limitation: In reactor water, thermal decomposition and oxidation of organics may yield corrosive species such as acids. The development of a method for their removal reduces the danger to components and relieves the burden on plant purification systems. The operating savings in exposure and funds from this process are sufficient for utilities to consider a full-scale installation. At Susquehanna, the ozone treatment would reduce the liquid waste discharge by 50% and the resin usage by 65%, thereby decreasing operating costs.

References: "Testing of an Organic Removal Process in BWR Radwaste Systems," EPRI NP-7195, Final Report, February 1993.

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